WHAT IS CLAIMED IS:

1. A method of data compression, comprising:

partitioning a first set of basis functions into groups, each group corresponding to a region, each basis function corresponding to one unknown in a system of linear equations, each of said basis functions corresponding to an original source;

selecting a plurality of spherical angles;

calculating a far-field disturbance produced by each of said basis functions in a first group for each of said spherical angles to produce a matrix of transmitted disturbances;

reducing a rank of said matrix of transmitted disturbances to yield a second set of basis functions, said second set of basis functions corresponding to composite sources, each of said composite sources comprising a linear combination of one or more of said original basis functions;

partitioning a first set of weighting functions into groups, each group corresponding one of said regions, each weighting function corresponding to a condition, each of said weighting functions corresponding to an original tester;

calculating a far-field disturbance received by each of said testers in a first group for each of said spherical angles to produce a matrix of received disturbances;

reducing a rank of said matrix of received disturbances to yield a second set of weighting functions, said second set of weighting functions corresponding to composite testers, each of said composite testers comprising a linear combination of one or more of said original testers;

transforming said system of linear equations to use said composite sources and said composite testers;

identifying a plurality of sub-matrices in said transformed system of linear equations; and

operating on said plurality of sub-matrices to solve said transformed system of linear equations.

2. A method for factorization of an interaction matrix, comprising:

identifying one or more small-valued elements of an interaction matrix;

setting said one or more small-valued elements to zero;

identifying one or more first sub-blocks in said interaction matrix, said first sub-blocks containing non-zero elements;

identifying one or more second sub-blocks in said interaction matrix, said second sub-blocks containing all zero elements; and

applying a decomposition to said interaction matrix by performing matrix operations on said first sub-blocks.

3. The method of Claim 2, wherein said decomposition comprises an LU decomposition.

4. The method of Claim 2, wherein said decomposition comprises matrix inversion.

5. The method of Claim 2, wherein said decomposition comprises an LDM decomposition.

6. The method of Claim 2, wherein at least one of said matrix operations is performed using optimized software.

7. The method of Claim 2, wherein either decompositions of first sub-blocks for a first block row below the main diagonal of said interaction matrix are substantially computed before decompositions on a second block row or a substantial number of decompositions of first sub-blocks for a first block column to the right of the main diagonal of said interaction matrix are substantially computed before decompositions on a second block column.

8. The method of Claim 2, wherein said factorization permits direct solution of a system of linear equations and wherein said direct solution comprises the division by a pivot.

9. A method , comprising:

generating a block-sparse matrix containing substantially full diagonal blocks and containing more than one substantially sparse block where said more than one substantially sparse block contain non zero elements in substantially similar locations:

identifying one or more sub-blocks in said block-sparse matrix, said sub-blocks containing a plurality of non-zero elements; and

applying a decomposition to said block-sparse matrix using said sub-blocks as a sub-matrix.

10. The method of Claim 9, wherein said decomposition comprises an LU decomposition.

11. The method of Claim 9, wherein said decomposition comprises matrix inversion.

12. The method of Claim 9, wherein said decomposition comprises an LDM decomposition.

13. The method of Claim 9, wherein at least one of the operations using said sub-blocks as a sub-matrix comprises running optimized decomposition software.

14. The method of Claim 9, wherein said factorization permits direct solution of a system of linear equations without further division by a pivot